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UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,438	06/26/2001	James L. Foran	15-4-1152.00	9657

26111	7590	09/22/2006	

STERNE, KESSLER, GOLDSTEIN & FOX PLLC
1100 NEW YORK AVENUE, N.W.
WASHINGTON, DC 20005

EXAMINER
YANG, RYAN R

ART UNIT	PAPER NUMBER
2628	

DATE MAILED: 09/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	09/888,438	FORAN, JAMES L.
	Examiner	Art Unit	
	Ryan R. Yang	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>05 September 2006</u>.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>2-5,7,9 and 10</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>2-5,7,9 and 10</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>9/5/2006</u>.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1.   A request for continued examination under 37 CFR 1.114, including the fee set

forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this

application is eligible for continued examination under 37 CFR 1.114, and the fee set

forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action

has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on

9/5/2006 has been entered.

2.   This action is responsive to communications: Amendment, filed on 9/5/2006.

This action is non-final.

3.   Claims 2-5, 7 and 9-10 are pending in this application. Claims 3 and 9 are

independent claims. In the Amendment, filed on 9/5/2006, claims 3 and 9 were

amended.

4.   The present title of the invention is "Method and system for presenting three-

dimensional computer graphics images using multiple graphics processing units" as

filed originally.

Claim Rejections - 35 USC § 103

5.   The text of those sections of Title 35, U.S. Code not included in this action can

be found in a prior Office action.

6.   Claims 2-5, 7 and 9-10 are rejected under 35 U.S.C. 103(a) as being

unpatentable over Knittel et al. (6,532,017) and further in view of Kaufman et al.

(5,760,781).

7.   As per claim 3, Knittel et al. (6,532,017), hereinafter Knittel, discloses a method for presenting three-dimensional computer graphics images of a scene using multiple graphics processing units, comprising the steps of:

(1) allocating, to the multiple graphics processing units, a set of three-dimensional computer graphics data such that said allocated set of three-dimensional computer graphics data corresponds to portions of the scene that lie within rectangular subvolumes to which the multiple graphics processing units have been assigned (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing element 210 having 4 parallel rendering pipelines 212 ... The processing element 210 obtains voxel data from the voxel memory 100 via voxel memory interface logic 216", column 14, line 61-63, where the rendering pipelines are the graphics processing units);

(2) determining a viewing position, wherein said determined viewing position determines an aspect of said allocated set of three-dimensional computer graphics data to be rendered (Figure 1 where the view direction determines a viewing position); and

(3) communicating said determined viewing position to the multiple graphics processing units ("All of the calculations for data positions having a given x coefficient modulo 4 are processed by the same rendering pipeline", column 15, line 11-16);

(4) rendering, by the multiple graphics processing units, substantially all of said allocated set of three-dimensional computer graphics data (where each pipeline can perform "interpolation, classification, gradient estimation, illumination, and compositing", Abstract);

(5) combining said rendered set of three-dimensional computer graphics data

with image combiners (Figure 4 29 "the colors, levels of brightness, and transparencies

assigned to all of the samples along all of the rays are applied as illustrated at 29 to a

compositing unit 124 that mathematically combines the sample values into pixels

depicting the resulting image 32 for display on image plane 16", column 9, line 34-40,

where the compositing unit is considered combiner), wherein outputs from the multiple

graphics processing units are direct inputs to first stage image combiners and outputs

from at least two of the first stage image combiners are direct inputs to a second stage

image combiner, thereby producing a three-dimensional computer graphics image; and

(6) presenting, for viewing, said combined three-dimensional computer graphics

image (Figure 4, item 32).

Knittel discloses a method for presenting three-dimensional computer graphics

images using multiple graphics processing units. It is noted that Knittel does not

explicitly disclose "outputs from the multiple graphics processing units are direct inputs

to first stage image combiners and outputs from at least two of the first stage image

combiners are direct inputs to a second stage image combiner, thereby producing a

three-dimensional computer graphics image", however, this is known in the art as taught

by Kaufman et al., hereafter Kaufman. Kaufman discloses a method of volume

visualization in which the voxel data is combined hierarchically (Figure 6 where voxel

combination unit 38 is considered an image combiner and a voxel is considered a

subvolume of a image).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate

the teaching of Kaufman into Knittel because Knittel discloses a method of presenting

three-dimensional computer graphics and Kaufman discloses the image is combined in

several stages in order to quickly generate a three-dimensional image.

8.   As per claim 2, Knittel and Kaufman demonstrated all the elements as disclosed

in the rejected claim 3, and Knittel further discloses loading, into memory cells

accessible by the multiple graphics processing units, the set of three-dimensional

computer graphics data corresponding to the portion portions of the scene that lies lie

within the rectangular subvolumes to which the multiple graphics processing unit units

have been assigned (Figure 6 204 "section memory 204 is used to store sections of a

volume during rendering of the volume data set by the VRC", column 14, line 47-48 and

Fig. 10 depicts loading of the subvolume to memory).

9.   As per claim 4, Knittel and Kaufman demonstrated all the elements as disclosed

in the rejected claim 3, and Kaufman further discloses wherein said combining further

comprises the step of

(5) ordering said rendered set of three-dimensional computer graphics data

based on locations between said determined viewing position and the rectangular

subvolumes to which the multiple graphics processing units have been assigned (Figure

1, item 6; "The conveyer 10 performs a deskewing operation in order to match the

physical sequential order of the input modules of the ray projection tree 6 to the

sequential order of the voxels of each viewing ray", column 2, line 3-6).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate the teaching of Kaufman into Knittel because Knittel discloses a method of presenting three-dimensional computer graphics and Kaufman discloses the image is combined in sequential order in order to generate a three-dimensional image related to a projection array.

10.   As per claim 5, Knittel and Kaufman demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses combining further comprises the step of:

(5) blending said rendered set of three-dimensional computer graphics data (Figure 4 29 "a compositing unit 124 that mathematically combines the sample values into pixels depicting the resulting image 32", column 9, line 36-39).

11.   As per claim 7, Knittel and Kaufman demonstrated all the elements as disclosed in the rejected claim 3, and Knittel further discloses wherein each of the image combiners has an associated frame buffer for storing said combined three-dimensional computer graphics image (Figure 14, item 200 where the pixel memory stores said combined three-dimensional computer graphics image).

12.   As per claim 9, Knittel discloses a system for presenting three-dimensional computer graphics images of a scene, comprising:

memory for storing a set of three-dimensional computer graphics data (Figure 14, item 100);

multiple graphics processing units for rendering substantially all of the set of three-dimensional computer graphics data that corresponds to portions of the scene

that lie within rectangular subvolumes to which said multiple graphics processing units

are assigned (Figure 7 V-Bus to 210 "The VRC 202 includes a pipelined processing

element 210 having 4 parallel rendering pipelines 212 ... The processing element 210

obtains voxel data from the voxel memory 100 via voxel memory interface logic 216",

column 14, line 61-63, where the rendering pipelines are considered multiple graphics

processing units);

a bus for communicating a viewing position to each of said multiple graphics

processing units, wherein the viewing position determines an aspect of the set of three-

dimensional computer graphics data to be rendered ("A first interpolation unit 244

interpolates the z-gradient in the z direction, resulting in four intermediate values",

column 12, line 64-66, therefore, the viewing direction is known by the GPU); and

image combiners for combining the set of three-dimensional computer graphics

data rendered by said multiple graphics processing units to produce a three-

dimensional computer graphics image (Figure 14 has a plurality of Compositing Unit),

wherein outputs from the multiple graphics processing units are direct inputs to first

stage image combiners and outputs from at least two of the first stage image combiners

are direct inputs to a second stage image combiner.

Knittel discloses a system for presenting three-dimensional computer graphics

images using multiple graphics processing units. It is noted that Knittel does not

explicitly disclose "outputs from the multiple graphics processing units are direct inputs

to first stage image combiners and outputs from at least two of the first stage image

combiners are direct inputs to a second stage image combiner, thereby producing a

three-dimensional computer graphics image", however, this is known in the art as taught

by Kaufman. Kaufman discloses a system of volume visualization in which the voxel

data is combined hierarchically (Figure 6 where voxel combination unit 38 is considered

an image combiner and a voxel is considered a subvolume of a image).

Thus, it would have been obvious to one of ordinary skill in the art to incorporate

the teaching of Kaufman into Knittel because Knittel discloses a system of presenting

three-dimensional computer graphics and Kaufman discloses the image is combined in

several stages in order to quickly generate a three-dimensional image.

13.   As per claim 10, Knittel and Kaufman demonstrated all the elements as disclosed

in the rejected claim 9, and Knittel further discloses said memory comprises memory

cells such that each of said memory cells is accessible by only one of the multiple

graphics processing units ("The voxels are supplied to the pipelines 210-0- 212-3,

respectively, in 4-voxel groups in a scanned order", column 15, line 9-11).

Response to Arguments

14.   Applicant's arguments filed 9/5/2006 have been fully considered but they are not
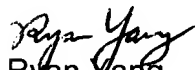
persuasive.

Applicant alleges Knittel or Kaufman do not teach rendering ... "substantially all

of said allocated set" of ... graphics data. In reply, Examiner considers a sample of the

set of data (as taught by Knittel and Kaufman) can be interpreted as "substantially all of

said allocated set" of data, or even as "allocated data".

Conclusion

15.   Any inquiry concerning this communication or earlier communications from

the examiner should be directed to Ryan R. Yang whose telephone number is (571)

272-7666. The examiner can normally be reached on M-F 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Michael Razavi can be reached on (571) 272-7664. The fax phone number

for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

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you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

Ryan Yang
Primary Examiner
September 18, 2006